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A New Species of the Echinoid *Rhynobrissus* (Spatangoida: Brissidae) from North-West Australia

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Abstract

A new species of *Rhynobrissus*, *R. tumulus*, is described on the basis of 21 tests found on the northern coast of Barrow Island, Western Australia. The species ranges from Barrow Island north to Broome. Significant ontogenetic changes are described and discussed. A revised key for *Rhynobrissus* is presented.

Introduction

Six species have been attributed to the brissid spatangoid *Rhynobrissus*; viz. *R. pyramidalis* Agassiz, 1872; *R. hemiasteroides* Agassiz, 1879; *R. micrasteroides* Agassiz, 1878; *R. placopetalus* Agassiz and H.L. Clark, 1907; *R. macropetalus* H.L. Clark, 1938; and *R. cuneus* Cooke, 1957. Only three of these six species, *R. pyramidalis*, the type species, *R. hemiasteroides* and *R. cuneus* are valid species of *Rhynobrissus*. *R. micrasteroides* was made the type species of *Neopneustes* by Duncan (1889). *R. placopetalus* was based on three juvenile specimens which are considered by Mortensen (1951: 487) to be young specimens of *R. pyramidalis*. Mortensen (1951) considers *R. macropetalus* to be a 'rather doubtful' species of *Rhynobrissus*, a view with which I concur. H.L. Clark (1938) based the species on a single specimen from Broome, Western Australia which was badly damaged prior to publication. The remaining fragments comprise a specimen much larger than any other species of *Rhynobrissus*. Its broad petals, the anterior pair of which diverge strongly anteriorly, and the posterior having rows of equidimensional pore pairs (see below), suggest a closer relationship to *Metalia* which, like *Rhynobrissus*, possesses peripetalous, subanal and anal fascioles.

Two of the valid species of *Rhynobrissus*, *R. pyramidalis* and *R. hemiasteroides*, have an Indo-Pacific distribution. *R. pyramidalis* has been recorded from China, Gulf of Thailand, Singapore and off Madras (Mortensen 1951). H.L. Clark (1946: 373) records the occurrence of a single specimen from near Darwin. *R. hemiasteroides* occurs around Tahiti and Hawaii (Mortensen 1951) and along the eastern and western coasts of Australia (H.L. Clark 1946). *R. hemiasteroides* has only been recorded from Western Australia near Broome (H.L. Clark 1946:

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374). However, specimens in the collections of the Western Australian Museum have been obtained from Rosemary Island in the Dampier Archipelago, 8 km north-west of Dongara, City Beach, Fremantle and off Pt Peron, suggesting that it occurs along much of the western coast of the continent. On the east coast of Australia, H.L. Clark (op. cit.) records it only from Queensland. It has been found at Shoal Point, Mackay and Bribie Island, Moreton Bay (Endean 1953, 1956). However, I have collected a specimen (WAM 1055-81) from Port Jackson, N.S.W. This is the most southerly record for both the species and the genus. *R. cuneus* was described by Cooke (1957) on the basis of specimens from the Atlantic coast of North Carolina. This greatly extends the range of the genus.

Recently, 21 tests of a species of *Rhynobrissus* were found washed up on the northern coast of Barrow Island, Western Australia. The specimens are clearly distinguishable from any of the three recognized species of *Rhynobrissus* and are herein described as a new species. The only other spatangoid echinoids known to live around Barrow Island are *Breynia desorii* Gray, 1851, *Rhynobrissus hemiasteroides*, (a single specimen of which [WAM 1053-81] was collected with the new species of *Rhynobrissus* described below) and an indeterminate species of *Brissus*. Other irregular echinoids which have been collected from around Barrow Island are *Peronella orbicularis* (Leske, 1778), *Clypeaster reticulatus* (Linnaeus, 1758) and *Echinolampas ovata* (Leske, 1778). The description of a new species of *Rhynobrissus* thus brings to seven the number of species of irregular echinoids recorded from around Barrow Island. Three further specimens of this new species of *Rhynobrissus*, from near the Monte Bello Islands, from Broome and from near Onslow, have subsequently been recognized in the collections of the Western Australian Museum.

Measurements of specimens were carried out using a vernier calliper to an accuracy of 0.1 mm. Relative sizes of features of the test are expressed as percentages of test length (%TL). Specimens examined in this study are housed in the collections of the Western Australian Museum(WAM), Australian Museum (AM) and British Museum (Natural History) (BM).

Systematics

Order Spatangoida Claus, 1876
Family Brissidae Gray, 1855
Genus *Rhynobrissus* Agassiz, 1872

Type Species

Rhynobrissus pyramidalis Agassiz, 1872: 58; by original designation.

Emended Diagnosis

Test small, fragile; frontal notch absent; ambulacrum III flush with test aborally and with very reduced pore pairs. Pore pairs in adaxial rows of posterior petals smaller adapically than abaxial rows. Posterior paired interambulacra not reaching peristome, being blocked by plates of ambulacra I, II, IV and V. Peripetalous, subanal and anal fascioles present; subanal without contained pore pairs; anal almost encircling periproct.

Remarks

Although the original spelling by Agassiz (1872) for the genus was *Rhynobrissus,* in later publications (Agassiz 1879) the name was spelt *Rhinobrissus*, as this is 'the linguistically correct form' (Mortensen 1951: 487). H.L. Clark (1917) reverted to *Rhynobrissus,* but Lambert and Thiéry (1924) and Mortensen (1951) spell it *Rhinobrissus.* This spelling is an unjustified emendation and consequently Agassiz (1872), Clark (1917), Cooke (1957) and Fischer (1966) are followed in using the original spelling, *Rhynobrissus.*

Rhynobrissus is most easily confused with *Metalia.* However, *Rhynobrissus* can be distinguished by the extremely reduced pore pairs in ambulacrum III aborally; smaller pore pairs in inner rows of the posterior petals, relative to outer rows; failure of interambulacra 1 and 4 to extend to the peristome; narrower, rectangular plastron; and absence of pore pairs within the subanal fasciole.

Rhynobrissus tumulus sp. nov.

Figures 1-5

Holotype

WAM 1047-81 (36.5 mm TL), a dried test collected from beach east of Cape Dupuy, northern coast of Barrow Island, Western Australia (20°40'S, 115°26'E) on 27 September, 1981 by K.J. McNamara, W.H. Butler and G.W. Kendrick; Figures 1A, B, 2A, B.

Paratypes

WAM 1048-81 (1), 1049-81 (1), 1050-81 (1), 1051-81 (11); BM 1981.10.27.1 (3); AM J14770 (1), J14771 (1), J14772 (1). All dried tests and collected from the same locality as the holotype.

Diagnosis

Aboral surface of test gently convex in longitudinal profile; highest posterior of apical system. Petals long and shallow; anterior pair transverse. Peristome narrow, labrum projecting only slightly anteriorly. Plastron narrow.

Description

Test ovoid, attaining a maximum known length of 60.0 mm; widest anterior of centre, width 82-88% TL; highest posterior of apical system at about mid-test length in interambulacrum 5, which is developed as a broad keel (Figure 2A) within area bounded by peripetalous fasciole; height 59-69% TL. Ventral half of posterior of test slightly inclined, periproct being visible from above (Figure 1A); dorsal half inclined forward. Apical system ethmolytic with four genital pores;

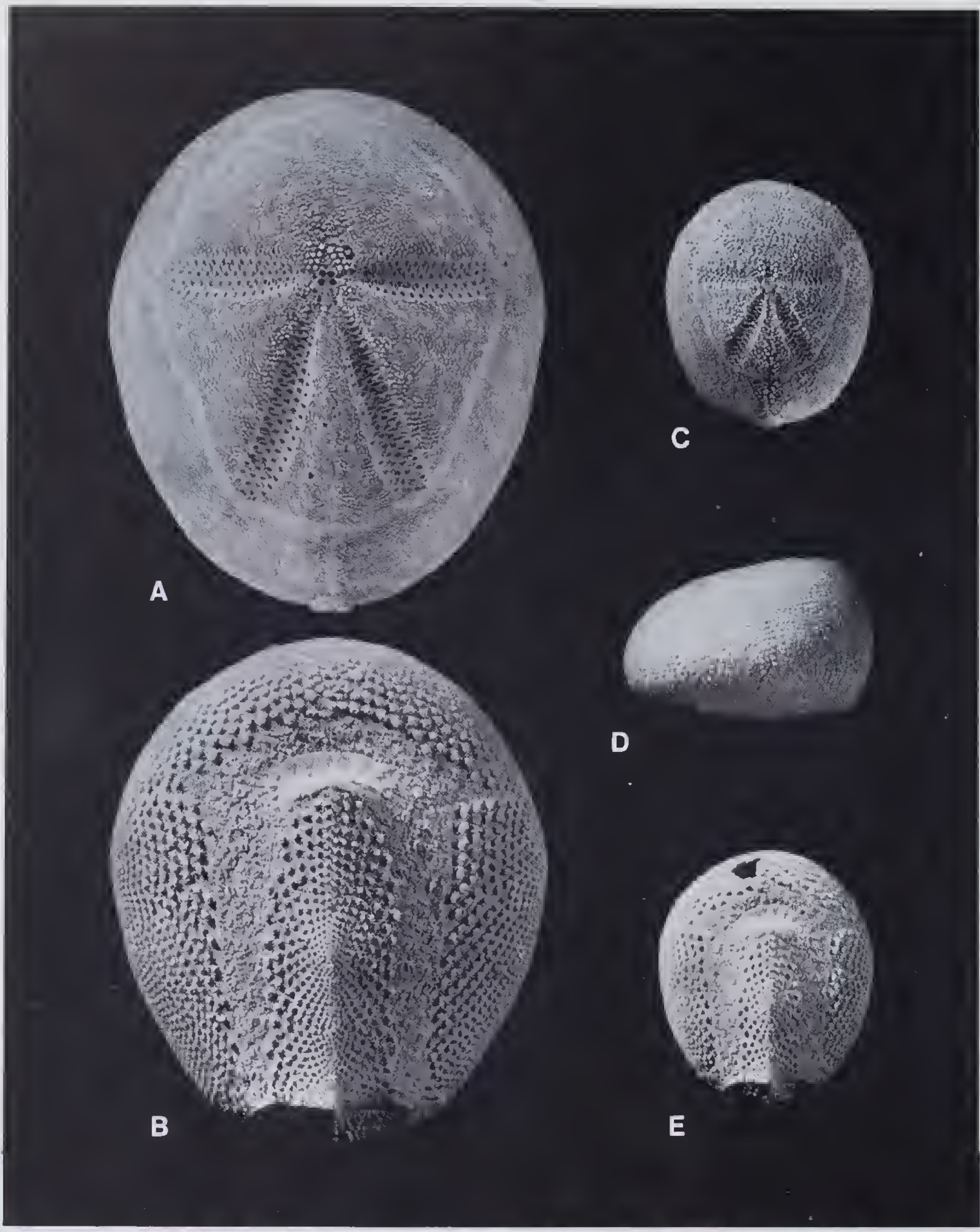

Figure 1 *Rhynobrissus tumulus* sp. nov.; aboral (A) and adoral (B) views of holotype WAM 1047-81; aboral (C), side (D) and adoral (E) views of paratype WAM 1048-81; all x 2.

anteriorly eccentric 35-44% TL from anterior ambitus. Anterior petals transverse; shallow; length of each petal 28-34% TL. Large specimens possess up to 19 pore pairs in each row; smallest specimen, 17.7 mm TL, possesses 16; pores oblong; pores of each row equidimensional; not conjugate; rows situated close to each other. Posterior petals diverge at 35°; longer than anterior petals, being 31-41% TL. Large specimens possess up to 27 pore pairs in each row; smallest specimen has 17. Pore pairs of each row equidimensional posteriorly, but pores of inner rows become relatively much smaller adapically, reducing to one third width of pore pairs of outer row close to apex (Figure 1A). Ambulacrum III flush with test aborally; no anterior notch. Extremely small, exsagittally orientated pore pairs present adapically. Peripetalous fasciole reaches close to anterior ambitus in largest specimens. Indented slightly in interambulacra 2, 3 or 5; reaches up to 0.7 mm in width. Area within peripetalous fasciole occupying up to 82% TL longitudinally and 69% TL transversely.

Oral surface of test gently convex; plastron forming sharp keel posteriorly (Figures 1B, 2A). Peristome lunate, width 22-28% TL; only slightly sunken. Wide area around peristome has a dense cover of miliary tubercles. Phyllode poorly developed: 8 small unipores in ambulacra II and IV; 5 in ambulacrum III; and 6 in ambulacra I and V. Basicoronal plates of ambulacra I and II, and ambulacra IV and V in contact, excluding interambulacra 1 and 4 (Figure 3). Labrum very short; lengthening slightly laterally; projecting a little anteriorly. Plastron narrow; sub-rectangular; width 22-28% TL. Periplastronal areas half width of plastron; covered by dense concentration of miliary tubercles. Subanal fasciole subcircular, but with slight posteriorly directed indentation ventro-medially; width 30% TL. Anal fasciole reaches to within 1 mm of subanal fasciole; broad adorally, up to 1.5 mm in width; almost encircles periproct, but branches do not join aborally (Figure 2A). Periproct small, oval, length 12% TL.

Adoral tuberculation largest on lateral and anterior interambulacra, tubercles 0.5 mm in diameter. On plastron tubercles become smaller toward axis. On aboral surface uniform tubercle size (0.2 mm), except for small area anterior of apical system where 0.35 mm in diameter. The small group of larger tubercles would probably have borne a tuft of stout, longer spines, as in *R. hemiasteroides*. On adoral surface, spines on plastron paddle-shaped burrowing spines, distal end of which is twice width of shaft; reaching up to about 17% TL in length. Locomotory spines on lateral and anterior interambulacra about 20% TL in length. All spines are white. Pedicellariae not known.

Ontogenetic Variation

Twenty-four specimens of this species are known. They range in test length from 17.7 to 60.0 mm. The smallest has genital pores which are very small and probably opened at only a slightly smaller test size. On the basis that the opening of genital pores indicates correlation with onset of maturity (McNamara and Philip 1980), all known specimens of *R. tumulus* are adults.

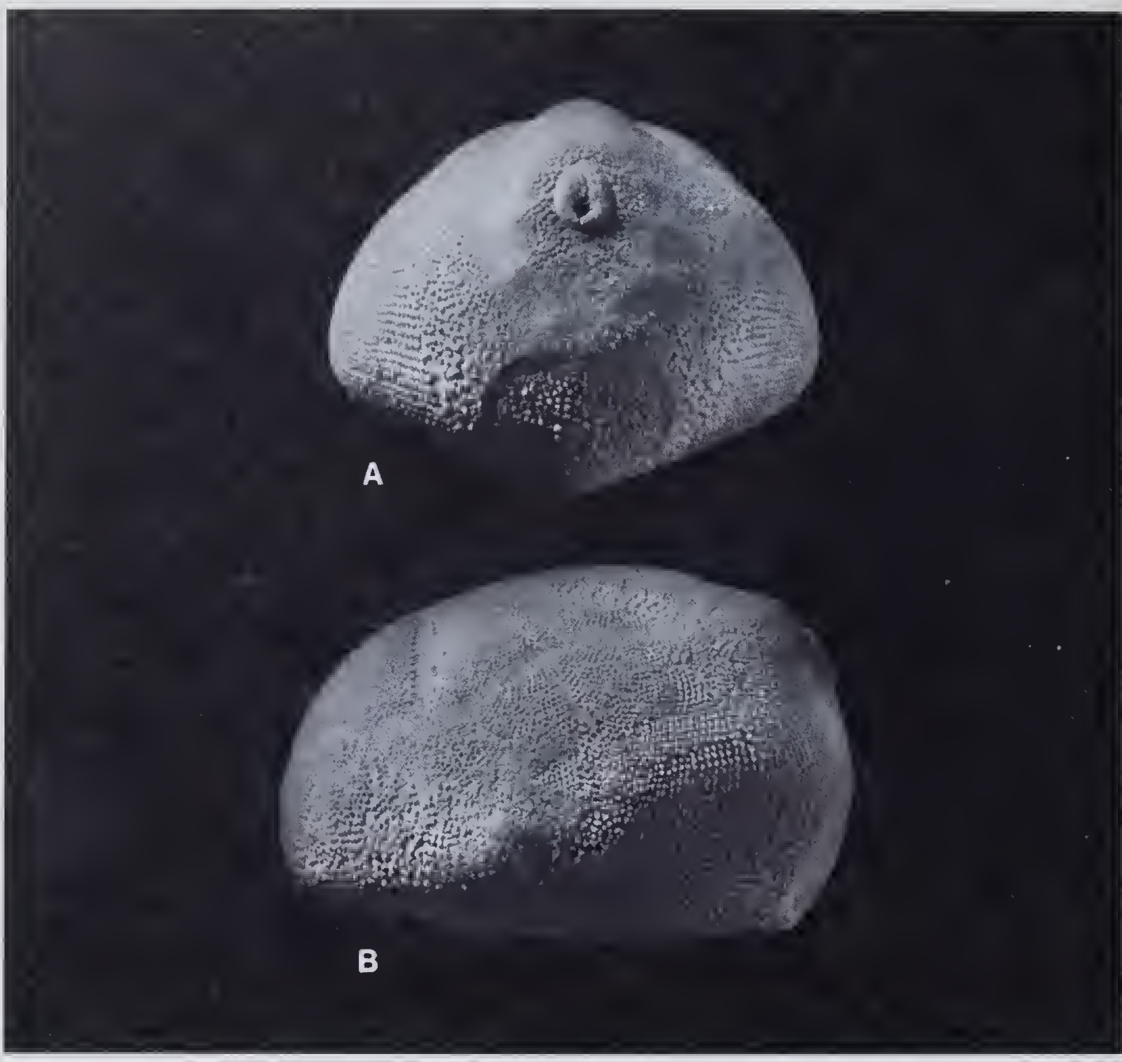

Figure 2 *Rhynobrissus tumulus* sp. nov.; posterior (A) and side (B) views of holotype WAM 1047-81; both x 2.

Significant ontogenetic changes occur to particular structures, however, even during adult growth. In the available specimens these changes occur with almost a fourfold increase in test length. The structures which change are: aboral interambulacrum 5; position of apical system and, consequently, orientation of anterior petals; lengths of petals relative to test; lengths of petals relative to one another; size of peristome; and shape of labrum. Changes to similar structures have been recorded in the ontogeny of the spatangoid *Schizaster myorensis* McNamara and Philip, 1980.

In the smallest specimen (Figure 1C-E) the aboral surface of the test is evenly rounded; with growth, interambulacrum 5 becomes more strongly vaulted and produces a slight keel. The apical system undergoes a slight anterior movement during growth. In the smallest specimens it may be as much as 44% TL from the anterior ambitus; in the largest specimens it reaches to within 35% TL of the anterior ambitus (Figure 4). As a consequence of this anterior movement there is a change in orientation of the anterior petals. In larger specimens the petals are transverse (Figure 1A); in the smallest specimens, where the apical system is more posteriorly situated, the anterior petals diverge forward at an angle of about 165° (Figure 1C).

Both sets of petals increase in length relative to the test during growth, the anterior petals from 28% TL to 34% TL, the posterior from 31% TL to 41% TL (Figure 5). The greater relative increase in length of the posterior petals means that they are proportionately longer than the anterior petals in larger individuals. In the specimen 17.7 mm TL, the petals are of almost equal length (28% TL and 31% TL); in the largest specimens the posterior petals are 25% longer than the anterior petals. Accompanying the relative lengthening of the petals there is a slight increase in number of pore pairs, from 16 to 19 in the anterior petals and

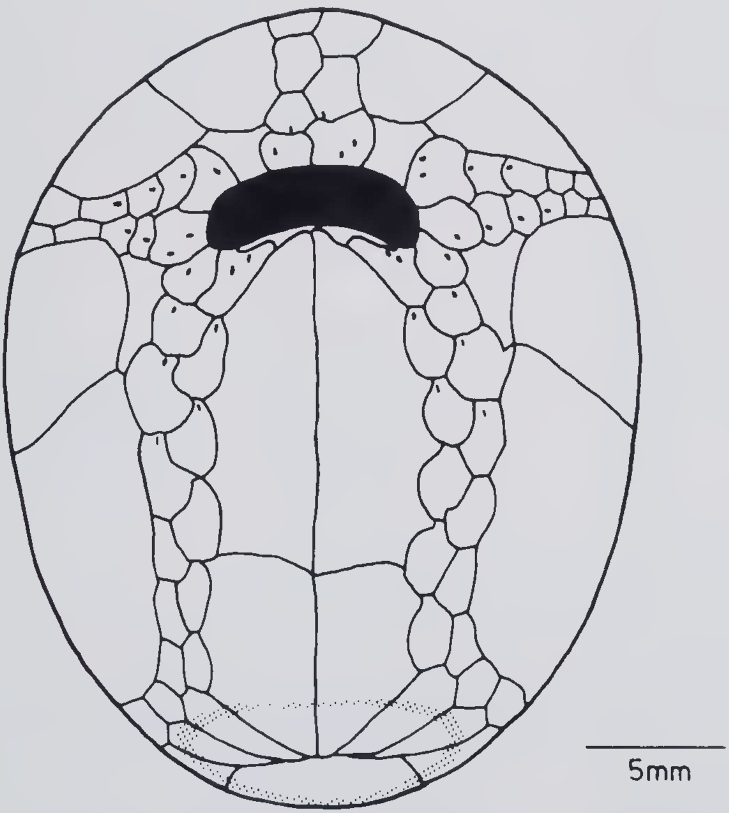

Figure 3 Camera lucida drawing of paratype of *Rhynobrissus tumulus*, WAM 1049-81, showing adoral plating. Note occlusion of interambulacral plates 1 and 4 from peristome.

from 17 to 27 in the posterior pair. Much of the relative size increase of the petals therefore reflects greater growth of the poriferous ambulacral plates relative to the adjoining interambulacral plates.

The peristome undergoes a slight relative decrease in width during growth of the test, from up to 28% TL in small specimens to 22% TL in the largest. An appreciable anteriorly directed growth of the labrum is reflected in a change to the shape of the peristome, from semicircular in small specimens to lunate in large ones. This is reflected in a decrease in the distance from the anterior tip of the labrum to the anterior ambitus, from 33% TL to 22% TL during growth of the test (Figure 4).

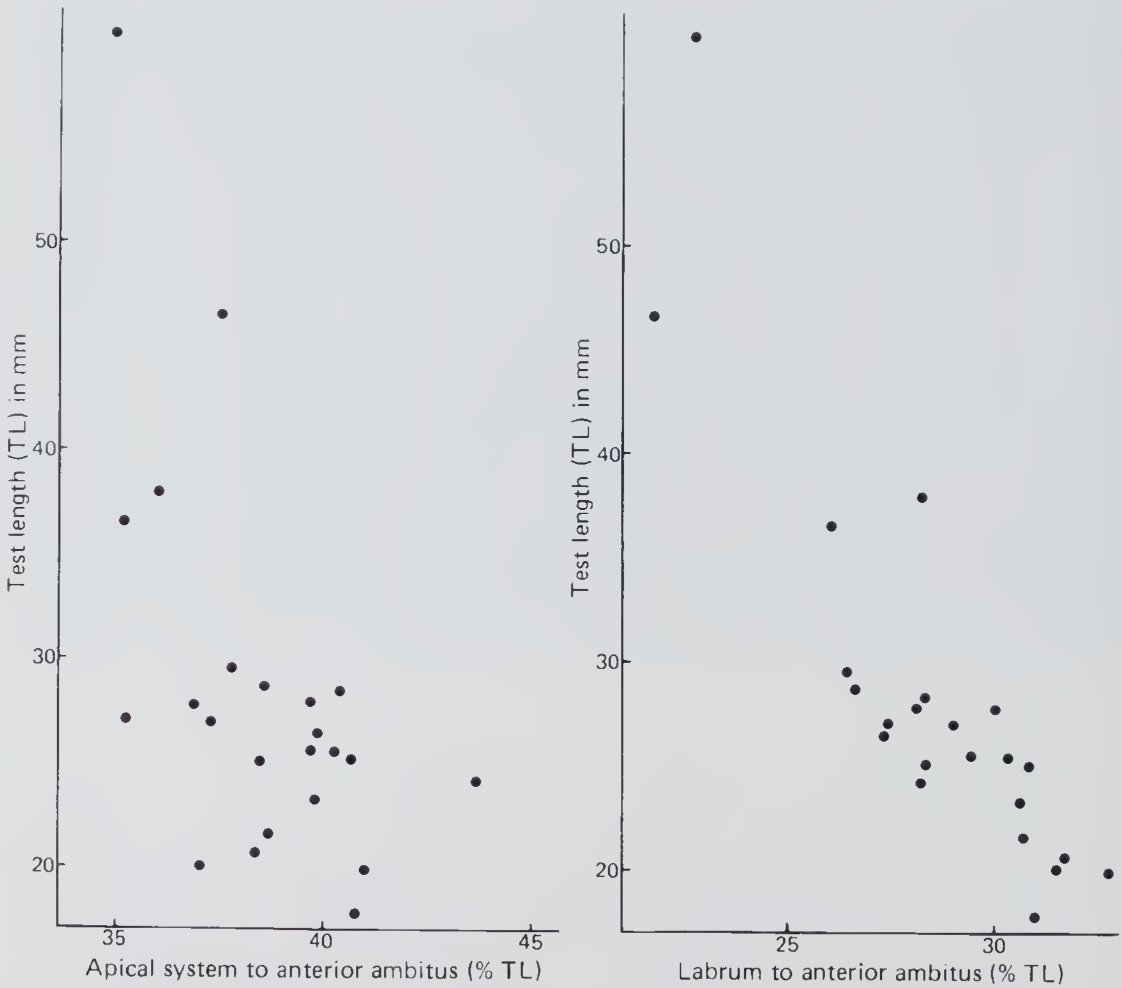

Figure 4 Plots of test length against distance of apical system to anterior ambitus and distance of labrum to anterior ambitus expressed as percentages of test length, for *Rhynobrissus tumulus.*

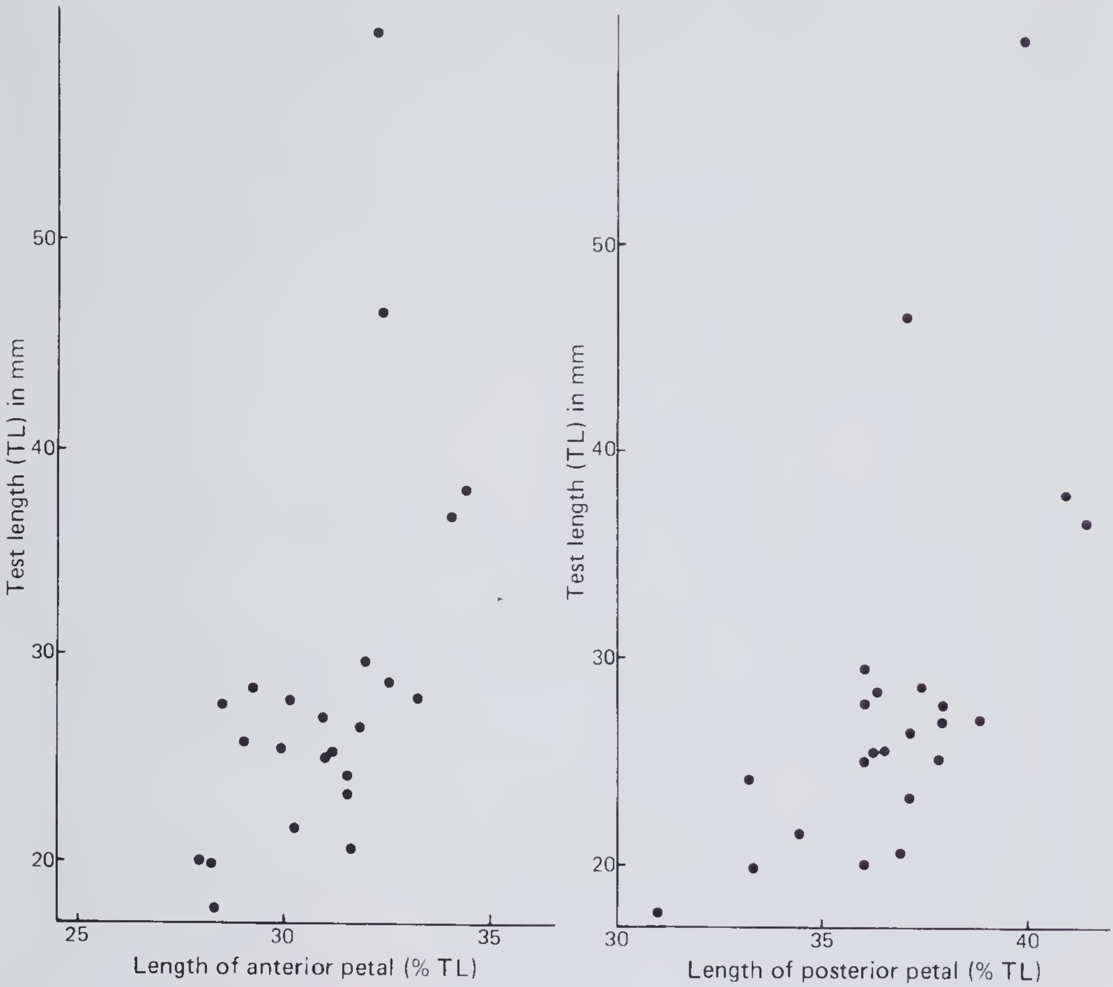

Figure 5 Plots of test length against length of anterior petal and length of posterior petal expressed as percentages of test length, for *Rhynobrissus tumulus*.

Remarks

Rhynobrissus tumulus differs from the other Australian species, *R. hemiasteroides*, with which it has been found, in a number of significant ways. *R. tumulus* lacks the 'hump' anterior of the apical system, so characteristic of *R. hemiasteroides*. It can further be distinguished by the form of the petals, which are longer (anterior 28-34%TL, posterior 31-41% TL, as opposed to 20-24% TL and 24-29% TL, respectively, in *R. hemiasteroides*). The petals are also slightly narrower and shallower in *R. tumulus*, and bear more pore pairs (a maximum of 19 in the anterior petals and 27 in the posterior, in contrast to maxima of only 12 and 16, respectively, in *R. hemiasteroides*). The peripetalous fasciole is situated much closer to the ambitus in *R. tumulus*. Furthermore, the peristome is less sunken and the labrum more transverse.

Rhynobrissus tumulus can be distinguished from the type species, *R. pyramidalis*, by its more oval test and the more anteriorly positioned apical system, which is set generally at 35-40% TL from the anterior in *R. tumulus*, but at 46% TL in the holotype of *R. pyramidalis*. The anterior petals are transverse in *R. tumulus*, but diverge anteriorly in *R. pyramidalis*. Furthermore, the petals are longer in *R. tumulus*, the anterior petals being only 21% TL in *R. pyramidalis*, and the posterior 31% TL. The peristome of *R. tumulus* is smaller and the labrum is more transverse. The plastron of *R. tumulus* is narrower, being 22-28% TL, in contrast to 33% TL in *R. pyramidalis*.

Rhynobrissus tumulus differs from *R. cuneus* in its more tumid test; its more anteriorly eccentric apical system (set at 42.5% TL from the anterior test in *R. cuneus*); its transverse anterior petals; its shorter labrum and the wider subanal fasciole, which is not in contact with the anal fasciole, as it is in *R. cuneus*.

It is significant that many of the characters used to distinguish species of *Rhynobrissus* are those which show appreciable change during ontogeny, suggesting variable developmental rates of particular structures may be important in the evolution of new species.

Although Barrow Island specimens were not collected alive, the presence of gut contents in one specimen (WAM 1050-81) provides some indication of the sediment substrate inhabited by *R. tumulus*. The specimen contained calcareous sand rich in foraminifers. The grain size of the sand varied in diameter between 0.1 and 1.0 mm. *R. tumulus* may thus be considered to be a moderately coarse sand dwelling species. The single specimen collected from north-east of the Monte Bello Islands (WAM 1052-81) is known to have been dredged from a depth of 50-52 m. *R. pyramidalis* has also been recorded from sand (Clark 1946, Mortensen 1951).

The observation that *R. tumulus* possesses paddle-shaped plastron spines, and the inference that it inhabits a sandy substrate, is at variance with deductions made by Smith (1980) that spatangoids which possess plastron spines that show distal flattening inhabit muddy substrates (e.g. in species of *Schizaster*, *Moira* and *Brissopsis*). The correlation between plastron spine shape and sediment type inhabited is probably not so clear-cut. For instance, species of *Brissus* possess plastron spines which are flattened distally, yet the genus inhabits sand (Chesher 1968, Mortensen 1951).

Other Material

WAM 1052-81 trawled from 50-52 m, north-east of Monte Bello Islands, Western Australia at about 20°21'S, 115°37-38'E; WAM 643-74, from sand flats near jetty at Broome, Western Australia; WAM 648-74, from west of Flat Island, near Long Island, off Onslow, Western Australia.

Etymology

From the latin 'tumulus' — a gentle mound, alluding both to the test shape and the Roman name for the six thousand year old burial mounds known as barrows.

Key to the Species of *Rhynobrissus*

1	Apex of test anterior of apical system	*R. hemiasteroides*
	Apex of test posterior of apical system	2
2	Apical system sub-central, anterior petals diverge	3
	Apical system anteriorly eccentric, anterior petals transverse	*R. tumulus*
3	Subanal fasciole not in contact with anal fasciole	*R. pyramidalis*
	Subanal fasciole in contact with anal fasciole	*R. cuneus*

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